RULES
OF
DEPARTMENT OF ENVIRONMENT AND CONSERVATION
DIVISION OF RADIOLOGICAL HEALTH

CHAPTER 1200-2-4
GENERAL PROVISIONS

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1200-2-4-.01 PURPOSE.

These regulations are intended to establish standards of radiation protection and are promulgated pursuant to provisions of Chapter 23, Tennessee Code Annotated, and do not in any way exempt any person from the provisions of the Code. These regulations are intended to be consistent with the safe use of radiation machines and radioactive materials.

Authority: *T.C.A. §68-28-101 et seq.* ***Administrative History:*** *Original rule certified June 7, 1974. Amendment filed August 15, 1978; effective October 2, 1978. Amendment filed September 17, 1980; effective November 3, 1980. Amendment filed April 3, 1986; effective May 31, 1986.*

1200-2-4-.02 SCOPE.

Except as otherwise specifically provided, these regulations apply to all persons who receive, possess, use, transfer, own or acquire any source of radiation, provided, however, that nothing in these regulations shall apply to any person to the extent such person is subject to regulations by the U.S. Nuclear Regulatory Commission.

Authority: *T.C.A. §68-28-101 et seq.* ***Administrative History:*** *Original rule certified June 7, 1974. Amendment filed August 15, 1978; effective October 2, 1978. Amendment filed April 3, 1986; effective May 31, 1986.*

1200-2-4-.03 EFFECTIVE DATE.

The provisions of these regulations shall be effective on the date of issue.

Authority: *T.C.A. §68-28-101 et seq.* ***Administrative History:*** *Original rule certified June 7, 1974. Amendment filed August 15, 1978; effective October 2, 1978. Amendment filed April 3, 1986; effective May 31, 1986.*

1200-2-4-.04 DEFINITIONS.

(1) As used in these regulations, these terms have the definitions set forth below. (For additional definitions used only in Chapters 1200-2-5, 1200-2-6, 1200-2-8 and 1200-2-9, see Rules 1200-2-5-.03, 1200-2-6-.03, 1200-2-8-.03 and 1200-2-9-.03.)

(a) 'A_1' means the maximum activity of special form radioactive material permitted in a Type A package. 'A_2' means the maximum activity of radioactive material, other than special form, LSA and SCO material, permitted in a Type A package. The values either are listed in Table A-1 of Rule 1200-2-10-.37 or may be derived in accordance with the procedures prescribed in Schedule 10-6, Rule 1200-2-10-.37.

(b) 'Accelerator-produced material' means any material made radioactive by an accelerator.

(c) 'Agreement State' means any state with which the U.S. Nuclear Regulatory Commission has entered into an effective agreement under Section 274 b. of the Atomic Energy Act of 1954, as amended (73 Statute 689).

(d) 'Alert' means a classification for events that are in progress, may occur or have occurred that could lead to a release of radioactive material(s) but that the release is not expected to require a response by an offsite response organization to protect persons offsite.

(e) 'Authorized nuclear pharmacist' means a pharmacist who is:

1. Board certified as a nuclear pharmacist by the Board of Pharmaceutical Specialties; or

2. Identified as an authorized nuclear pharmacist on a license issued by the Division, the U.S. Nuclear Regulatory Commission (U.S. NRC), or another Agreement State, that authorizes the use of radioactive material in the practice of nuclear pharmacy.

(f) 'Authorized user' means a physician, dentist or podiatrist who is:

1. Board certified by at least one of the boards listed in subparagraph 1200-2-10-.33(1)(e), 1200-2-10-.33(4)(d), or 1200-2-10-.33(5)(a); or

2. Identified as an authorized user on a license issued by the Division, the U.S. Nuclear Regulatory Commission (U.S. NRC), or another Agreement State, that authorizes the medical use of radioactive material.

(g) 'Barrier' means attenuating materials used to reduce radiation exposure.

1. Primary. Barrier sufficient to attenuate the useful beam to the required degree at a distance no greater than 8 centimeters beyond the barrier.

2. Secondary. Barrier sufficient to attenuate scattered and leakage radiation to the required degree at a distance no greater than 8 centimeters beyond the barrier. [1]

(h) 'Calibration' means the determination of:

1. The response or reading of an instrument relative to a series of known radiation values over the range of the instrument, or

2. The strength of a source of radiation relative to a standard.

(i) 'Carrier' means a person engaged in the transportation of passengers or property by land or water as a common, contract or private carrier, or by civil aircraft.

(j) 'Conveyance' means:

1. For transport by public highway or rail: any transport vehicle or large freight container;

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[1] *It is reasonable to assume that individuals will not occupy the area within 8 centimeters of the barrier continuously.*

2. For transport by water: any vessel, or any hold, compartment, or defined deck area of a vessel including any transport vehicle on board the vessel; and

3. For transport by aircraft: any aircraft.

(k) 'Critical group' means the group of individuals reasonably expected to receive the greatest exposure to residual radioactivity for any applicable set of circumstances.

(l) 'Curie.' Defined in 1200-2-5-.34.

(m) 'Decommission' means to remove a facility or site safely from service and reduce residual radioactivity to a level that permits:

1. Release of the property for unrestricted use and termination of the license; or

2. Release of the property under restricted conditions and the termination of the license.

(n) 'Disposal facility' means a land disposal site that is used for the isolation of radioactive waste from the biosphere.

(o) 'Distinguishable from background' means that the detectable concentration of a radionuclide is statistically different from the background concentration of that radionuclide in the vicinity of the site or, in the case of structures, in similar materials using adequate measurement technology, survey and statistical techniques.

(p) Reserved.

(q) 'Dose.' Defined in 1200-2-5-.32(22).

(r) 'Emergency procedures' means the written pre-planned steps to be taken in the event of actual or suspected exposure of individuals to excessive radiation. This procedure should include the names and telephone numbers of individuals to be contacted as well as directives for processing the film badge or other personnel-monitoring device.

(s) 'Exclusive use' (or 'sole use' or 'full load') means sole use by a single consignor of a conveyance for which all initial, intermediate and final loading and unloading are carried out in accordance with the direction of the consignor or consignee. The consignor and the carrier shall ensure that personnel having radiological training and resources appropriate for safe handling of the consignment perform any loading or unloading. The consignor shall issue specific written instructions for maintenance of exclusive use shipment controls and include them with the shipping paper information provided to the carrier by the consignor.

(t) 'Exposure' [2] means a measure of the ionization produced in air by X or gamma radiation. It is the sum of the electrical charges on all of the ions of one sign produced in air, when all electrons liberated by photons in a volume element of air are completely stopped in air, divided by the mass of the air in the volume element. The special unit of exposure is the roentgen.

(u) 'Fissile material' means plutonium-238, plutonium-239, plutonium-241, uranium-233, uranium-235 or any combination of these radionuclides. Fissile material does not apply to unirradiated natural uranium and depleted uranium, and natural uranium or depleted uranium that has been irradiated in a thermal reactor.

[2] *It is reasonable to assume that individuals will not occupy the area within 8 centimeters of the barrier continuously.*

(v) 'Fissile material package.' See 'Package'

(w) 'Former U.S. Atomic Energy Commission (AEC) or U.S. Nuclear Regulatory Commission (NRC) licensed facilities' means nuclear reactors, nuclear fuel processing plants, uranium enrichment plants, or critical mass experimental facilities where AEC or NRC licenses have been terminated.

(x) 'Generator' means a person whose activities with radioactive material are such that waste is generated that is distinctly separate and/or distinct from materials received.

(y) 'Human use' (or medical use) means the intentional internal or external administration of radiation or radioactive materials to individuals under the supervision of an authorized user.

(z) 'Interlock' means a device for precluding access to any area of radiation hazard by automatically eliminating the hazard upon entry by personnel or parts of their body.

(aa) 'Licensing State' means any state with regulations equivalent to the Suggested State Regulations for Control of Radiation relating to, and an effective program for, the regulatory control of NARM.

(bb) 'Low specific activity (LSA) material' means radioactive material with limited specific activity that satisfies the following descriptions and limits. Shielding materials surrounding the LSA material may not be considered in determining the estimated average specific activity of the package contents.

1. LSA-I

(i) Ores containing only naturally occurring radionuclides (e.g., uranium, thorium) and uranium or thorium concentrates of these ores; or

(ii) Solid unirradiated natural uranium or depleted uranium or natural thorium or their solid or liquid compounds or mixtures; or

(iii) Radioactive material, other than fissile material, for which the A_2 value is unlimited; or

(iv) Mill tailings, contaminated earth, concrete, rubble, other debris and activated material in which the radioactive material is essentially uniformly distributed and the average specific activity does not exceed 1 (E-6) A_2/gram.

2. LSA-II

(i) Water with tritium concentration up to 20 Ci/liter (0.8 terrabequerel/liter); or

(ii) Material in which the radioactive material is distributed throughout and the average specific activity does not exceed 1 (E-4) A_2/gram for solids and gases or 1 (E-5) A_2/gram for liquids.

3. LSA-III. Solids (e.g., consolidated wastes, activated materials) in which:

(i) The radioactive material is distributed throughout a solid or a collection of solid objects or is essentially uniformly distributed in a solid compact binding agent (such as concrete, bitumen, ceramic, etc.); and

(ii) The radioactive material is relatively insoluble, or it is intrinsically contained in a relatively insoluble material, so that even under loss of packaging, the loss of radioactive material per package by leaching, when placed in water for seven (7) days, would not exceed 0.1 A_2; and

(iii) The average specific activity of the solid does not exceed 2 (E-3) A_2/gram.

(cc) 'Low toxicity alpha emitters' means natural uranium, depleted uranium, natural thorium, uranium-235, uranium-238, thorium-232, thorium-228 or thorium-230 when contained in ores or physical or chemical concentrates or tailings; or alpha emitters with a half-life of less than ten (10) days.

(dd) 'Major processors' means persons processing or handling radioactive materials exceeding Type X quantities[3] as unsealed sources or material.

(ee) 'Maximum normal operating pressure' means the maximum gauge pressure that would develop in the containment system in a period of one (1) year under the heat condition specified in 10 CFR 71.71(c)(1), in the absence of venting, external cooling by an ancillary system or operational controls during transport.

(ff) 'NARM' means any naturally occurring or accelerator-produced radioactive material. It does not include byproduct, source or special nuclear material.

(gg) 'Natural radioactivity' means radioactivity of naturally occurring nuclides.

(hh) 'Natural thorium' means thorium with the naturally occurring distribution of thorium isotopes (essentially 100 weight percent thorium-232).

(ii) 'Normal form radioactive material' means radioactive material that has not been demonstrated to qualify as special form radioactive material.

(jj) 'Operating procedures' means detailed written instructions including, but not limited to, the normal operation of equipment and movable shielding, closing of interlock circuits, manipulation of controls, radiation monitoring procedures for personnel and areas, testing of interlocks and record keeping requirements.

(kk) 'Ore refineries' means all non-exempt processors of a radioactive material ore.

(ll) 'Package' means the packaging together with its radioactive contents as presented for transport.

1. 'Fissile material package' means a fissile material packaging together with its fissile material contents.

2. 'Type B package' means a Type B packaging together with its radioactive contents. On approval, a Type B package design is designated by NRC as B(U) unless the package has a maximum normal operating pressure of more than 700 kPa (100 lbf/in^2) gauge or a pressure relief device that would allow the release of radioactive material to the environment under the tests specified in 10 CFR 71.73 (hypothetical accident

[3] *Type X quantities are defined in Tables RHS 2–1, RHS 2–2 and RHS 2–3 as contained in Chapter 1200–2–5. For purposes of 1200–2–4–.04(1)(dd), where there is involved a combination of radioactive materials licensed, the method of deriving a Type X quantity is as specified in 1200–2–5–.162(1)(b).*

conditions), in which case it will receive a designation B(M). B(U) refers to the need for unilateral approval of international shipments; B(M) refers to the need for multilateral approval of international shipments. There is no distinction made in how packages with these designations may be used in domestic transportation. To determine their distinction for international transportation, see U.S. DOT regulations in 49 CFR 173. A Type B package approved before September 6, 1983, was designated only as Type B. Limitations on its use are specified in 10 CFR 71.13.

(mm) 'Packaging' means the assembly of components necessary to ensure compliance with the packaging requirements of this chapter. It may consist of one or more receptacles, absorbent materials, spacing structures, thermal insulation, radiation shielding and devices for cooling or absorbing mechanical shocks. The vehicle, tie-down system and auxiliary equipment may be designated as part of the packaging.

(nn) 'Physician' means an individual licensed by the State to dispense drugs in the practice of medicine.

(oo) 'Qualified individual.' Defined in 1200-2-6-.03.

(pp) 'Qualified expert' means, for purposes of 1200-2-7-.04(4) and 1200-2-9-.21(2)(g) and (m), a person:

1. Who is certified by the American Board of Radiology in Therapeutic Radiological Physics, Radiological Physics, Roentgen-Ray and Gamma-Ray Physics or X-Ray and Radium Physics; or

2. Who has the following [4] minimum training and experience:

(i) A Master's or Doctor's degree in physics, biophysics, radiological physics or health physics;

(ii) One year of full-time training in therapeutic radiological physics; and

(iii) One year of full-time experience in a therapy facility including personal calibration and spot check of at least one teletherapy unit.

(qq) 'Rad.' Defined in 1200-2-5-.33(1)(b).

(rr) 'Radiation machine' means any device capable of producing radiation except devices that produce radiation through utilization of a radioactive material.

(ss) 'Radioactive material' means any material, solid, liquid or gas, which emits radiation spontaneously.

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[4] *Licensees or certified registrants that utilize persons who do not meet these criteria for minimum training and experience may request a variance excepting them from the requirements of using qualified experts. The request should include:*

1. *The name of the proposed individual,*
2. *A description of his or her training and experience including information similar to that specified in 1200–2–4–.04(1)(pp)2,*
3. *Reports of at least one calibration and spot–check program based on measurements personally made by the proposed individual within the last 10 years, and*
4. *Written endorsement of the technical qualifications of the proposed individual from personal knowledge by a physicist certified by the American Board of Radiology in one of the specialties listed in1200–2–4–.04(1) (pp)1.*

The variance request should be addressed to the Division of Radiological Health, at the address given in Rule 1200–2–4–.07.

(Rule 1200-2-4-.04, continued)

(tt) 'Radiological safety officer' means the qualified individual directly responsible for the safety of all persons at an installation using sources of radiation from hazards associated with such sources. This individual shall have the authority to stop operations whenever he believes that persons are being endangered. (Some other commonly used titles to identify this individual are Radiation Protection Officer and Radiation Safety Officer.)

(uu) 'Rem.' Defined in 1200-2-5-.33(1)(c).

(vv) 'Research and development' means theoretical analysis, exploration or experimentation; or extension of investigative findings and theories of a scientific or technical nature into practical application for experimental and demonstration purposes. Research and development includes the experimental production and testing of models, devices, equipment, materials and processes. Research and development does not include the internal or external administration of radiation or radioactive material to individuals.

(ww) 'Residual radioactivity' means radioactivity in structures, materials, soils, groundwater and other media at a site resulting from activities under the licensee's control. This includes radioactivity from all licensed and unlicensed sources used by the licensee, but excludes background radiation. It also includes radioactive materials remaining at the site as a result of routine or accidental releases of radioactive material at the site and previous burials at the site, even if those burials were made in accordance with the provisions of Chapter 1200-2-5.

(xx) 'Roentgen' (R) means the special unit of exposure. One roentgen equals 2.58×10^{-4} coulomb per kilogram of air.

(yy) 'Sealed source' means any radioactive material that is permanently bonded or fixed in a capsule or matrix designed to prevent release or dispersal of the radioactive material under the most severe conditions likely to be encountered in normal use and handling.

(zz) 'Site area emergency' means a classification for events that are in progress, may occur or have occurred that could lead to a significant release of radioactive material and that could require a response by offsite response organizations to protect persons offsite.

(aaa) 'Source of radiation' means material that emits radiation spontaneously, or apparatus that produces, or may produce when the associated controls are operated, one or more forms of radiation.

(bbb) 'Special form radioactive material' means radioactive material that satisfies the following conditions:

1. It either is a single solid piece or is contained in a sealed capsule that can be opened only by destroying the capsule;

2. The piece or capsule has at least one dimension not less than 5 millimeters (0.197 inch); and

3. It satisfies the test requirements specified by the U.S. Nuclear Regulatory Commission. A special form encapsulation designed in accordance with the U.S. NRC requirements in effect on June 30, 1983, and constructed before July 1, 1985, may continue to be used. A special form encapsulation designed in accordance with U.S. NRC requirements in effect on March 31, 1996, and constructed before April 1, 1998, may continue to be used. Any other special form encapsulation shall meet the specifications of this definition applicable at the time of its design or construction.

(Rule 1200-2-4-.04, continued)

(ccc) 'Special nuclear material in quantities not sufficient to form a critical mass' means:

1. Uranium enriched in the isotope U-235 in quantities not exceeding 350 grams of contained U-235;

2. Uranium-233 in quantities not exceeding 200 grams;

3. Plutonium in quantities not exceeding 200 grams; or

4. Any combination of them in accordance with the following formula. For each kind of special nuclear material, determine the ratio between the quantity of that special nuclear material and the quantity specified above for the same kind of special nuclear material. The sum of such ratios for all kinds of special nuclear material in combination shall not exceed 1 (i.e., unity). For example, the following quantities in combination would not exceed the limitation and are within the formula, as follows:

$$\frac{175 \text{ (grams contained U-235)}}{350} + \frac{50 \text{ (grams U-233)}}{200} + \frac{50 \text{ (grams Pu)}}{200} = 1$$

(ddd) 'Specific activity' means the radioactivity of a radionuclide per unit mass of that nuclide. The specific activity of a material in which the radionuclide is essentially uniformly distributed is the radioactivity per unit mass of the material.

(eee) 'Surface contaminated object' (SCO) means a solid object that is not itself classed as radioactive material but that has radioactive material distributed on any of its surfaces. Surface activity shall not exceed the following limits:

1. SCO-I: A solid object on which:

(i) The removable (non-fixed) contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 1 E-4 microcurie (4 becquerels) per square centimeter (cm^2) for beta and gamma and low toxicity alpha emitters or 1 E-5 microcuries (0.4 becquerel) per cm^2 for all other alpha emitters;

(ii) The fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 1 microcurie (4 E+4 becquerels) per square centimeter (cm^2) for beta and gamma and low toxicity alpha emitters or 0.1 microcurie (4 E+3 becquerels) per cm^2 for all other alpha emitters; and

(iii) The removable contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 1 microcurie (4 E+4 becquerels) per square centimeter (cm^2) beta and gamma and low toxicity alpha emitters or 0.1 microcurie (4 E+3 becquerels) per cm^2 for all other alpha emitters.

2. SCO-II: A solid object on which the limits for SCO-I are exceeded and on which:

(i) The removable contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 1 E-2 microcurie (400 becquerels) per square centimeter (cm^2) for beta and gamma and low toxicity alpha emitters or 1 E-3 microcurie (40 becquerels) per cm^2 for all other alpha emitters;

(ii) The fixed contamination on the accessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 20 microcuries (8 E+5 becquerels) per square centimeter (cm^2) for beta and gamma and low toxicity alpha emitters or 2 microcuries (8 E+4 becquerels) per cm^2 for all other alpha emitters; and

(iii) The removable contamination plus the fixed contamination on the inaccessible surface averaged over 300 cm^2 (or the area of the surface if less than 300 cm^2) does not exceed 20 microcurie (8 E+5 becquerels) per square centimeter (cm^2) for beta and gamma and low toxicity alpha emitters or 2 microcurie (8 E+4 becquerels) per cm^2 for all other alpha emitters.

(fff) 'Therapeutic-type protective tube housing' means:

1. For x-ray therapy apparatus not capable of operating at 500 kVp or above, the following definition applies. An x-ray tube housing so constructed that the leakage radiation at a distance of 1-meter from the target does not exceed 1 roentgen in an hour when the tube is operated at its maximum rated continuous current for the maximum rated tube potential.

2. For x-ray therapy apparatus capable of operating at 500 kVp or above, the following definition applies. An x-ray tube housing so constructed that the leakage radiation at a distance of 1-meter from the target does not exceed 0.1 percent of the useful beam exposure rate at 1-meter from the target, for any of its operating conditions.

3. In either case, small areas of reduced protection are acceptable providing the average radiation exposure over any area of 100 square centimeters at 1-meter distance from the target does not exceed the values given above. However, no linear dimension of the area used to obtain the average shall exceed 20 centimeters.

4. See 1200-2-6-.05(1)(a)15 for leakage requirements for contact therapy apparatus.

(ggg) 'These regulations' means "State Regulations for Protection Against Radiation."

(hhh) 'Transport index' (TI) means the dimensionless number (rounded up to the next tenth) placed on the label of a package to designate the degree of control to be exercised by the carrier during transportation. The transport index is the number determined by the maximum radiation level in millirem per hour at 1-meter (3.3 feet) from the external surface of the package (equivalent to multiplying the maximum radiation level in millisievert(s) per hour at 1-meter (3.3 feet) by 100). The transport index is determined as follows:

1. For non-fissile material packages, the number determined by multiplying the maximum radiation level in millisievert (mSv) per hour at 1-meter (3.3 ft) from the external surface of the package by 100 (equivalent to the maximum radiation level in millirem per hour at 1-meter (3.3 ft)); or

2. For fissile material packages, the number determined by multiplying the maximum radiation level in millisievert per hour at 1-meter (3.3 ft) from the external surface of the package by 100 (equivalent to the maximum radiation level in millirem per hour at 1-meter (3.3 ft)), or, for criticality control purposes, the number obtained as described in 10 CFR 71.59, whichever is larger.

(Rule 1200-2-4-.04, continued)

(iii) 'Type A quantity' means a quantity of radioactive material, the aggregate radioactivity of which does not exceed A_1 for special form radioactive material or A_2 for normal form radioactive material, where A_1 and A_2 are given in Table A-1, Schedule 10-6, Rule 1200-2-10-.37, or may be determined by procedures described in Schedule 10-6, Rule 1200-2-10-.37.

(jjj) 'Type B quantity' means a quantity of radioactive material greater than a Type A quantity.

(kkk) 'Units of radioactivity.' Defined in 1200-2-5-.34.

(lll) 'Unrefined and unprocessed ore' means ore in its natural form before any processing, such as grinding, roasting, beneficiating or refining.

(mmm) 'Uranium - natural, depleted, enriched' means:

1. Natural uranium: uranium with the naturally occurring distribution of uranium isotopes (about 0.711 weight percent uranium-235, and the remainder by weight essentially uranium-238).

2. Depleted uranium: uranium containing less uranium-235 than the naturally occurring distribution of uranium isotopes.

3. Enriched uranium: uranium containing more uranium-235 than the naturally occurring distribution of uranium isotopes.

(nnn) 'Useful beam' (or 'primary beam') means that part of the radiation that passes through a window, aperture, cone or other collimating device.

(ooo) 'Waste' means those low-level radioactive wastes containing radioactive materials that are acceptable for disposal at a land disposal facility. For the purposes of this definition, low-level waste is radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel or byproduct material as defined in Section 11e.(2) of the Atomic Energy Act (uranium or thorium tailings and waste).

(ppp) 'Waste handler' means a person who holds radioactive wastes for disposal and/or who actually disposes of radioactive wastes for other persons.

(qqq) 'Waste processor' means a waste handler who performs a physical and/or chemical activity on a material containing or contaminated with radioactive material.

(rrr) 'Worker' means an individual engaging in work under a license or registration issued by the Division and controlled by a licensee or registrant, but does not include the licensee or registrant.

(2) Definitions of certain other words and phrases used in these regulations are set forth in other parts of these regulations where they specifically apply.

Authority: *T.C.A. §§4-5-201 et seq., 68-202-101 et seq. and 68-202-201 et seq.* ***Administrative History:*** *Original rule certified June 7, 1974. Amendment filed August 15, 1978; effective October 2, 1978. Amendment filed September 17, 1980; effective November 3, 1980. Amendment filed April 3, 1986; effective May 31, 1986. Amendment filed January 8, 1990; effective May 1, 1990. Amendment filed May 9, 1990; effective August 29, 1990. Amendment filed March 31, 1992; effective May 15, 1992. Amendment filed July 18, 2002; effective October 1, 2002. Amendment filed November 17, 2005; effective January 31, 2006.*

1200-2-4-.05 UNITS OF RADIATION DOSE.

(1) Dose is the quantity of radiation absorbed per unit mass by the body. When these regulations specify a dose during a period of time, the dose means the total quantity of radiation absorbed, per unit of mass, by the body during such period of time. Several different units of dose are in current use. Definitions of units as used in these regulations are set forth in (2) and (3) of this rule.

(2) The rad is a measure of the dose of radiation to any material in terms of the energy absorbed per unit mass of the material. One rad is the dose corresponding to the absorption of 100 ergs per gram of material. (One millirad (mrad) = 0.001 rad)

(3) The rem is a measure of the dose of any radiation to the body tissue in terms of its estimated biological effects relative to an exposure of one roentgen (R) of x-rays. (One millirem (mrem) = 0.001 rem). The relation of the rem to other dose units depends on the biological effect under consideration and upon the conditions of irradiation. For the purpose of these regulations, any of the following is considered to be equivalent to a dose of one rem:

(a) An *exposure* of 1 R due to x- or gamma radiation;

(b) A dose of 1 rad due to x-, gamma or beta radiation;

(c) A dose of 0.1 rad due to neutrons or high energy protons;[5]

(d) A dose of 0.05 rad due to particles heavier than proton and with sufficient energy to reach the lens of the eye.

(4) For determining the doses as specified in 1200-2-5-.03 and 1200-2-5-.06(1), a dose from x- or gamma rays up to 3 MeV may, for purposes of these regulations, be assumed to be equivalent to the exposure measured in air at or near body surfaces in the region of the highest exposure by an appropriate instrument properly calibrated.

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[5] *If it is more convenient to measure the neutron flux, or equivalent, than to determine the neutron absorbed dose in rads, one rem of neutron radiation may, for purposes of these regulations, be assumed to be equivalent to 14 million neutrons per square centimeter incident upon the body; or, if there exists sufficient information to estimate with reasonable accuracy the approximate distribution in energy of the neutrons, the incident number of neutrons per square centimeter equivalent to one rem may be estimated from the following table:*

Neutron Flux Dose Equivalents

Neutron Energy (MeV)	*Number of neutrons per square centimeter equivalent to a dose of 1 rem (Neutrons/cm^2)*	*Average flux to deliver100 milli-rem in 40 hours (Neutrons/cm^2 per sec.)*
Thermal	*970 x 10^6*	*670*
0.0001	*720 x 10^6*	*500*
0.005	*820 x 10^6*	*570*
0.02	*400 x 10^6*	*280*
0.1	*120 x 10^6*	*80*
0.5	*43 x 10^6*	*30*
1.0	*26 x 10^6*	*18*
2.5	*29 x 10^6*	*20*
5.0	*26 x 10^6*	*18*
7.5	*24 x 10^6*	*17*
10	*24 x 10^6*	*17*
10 to 30	*14 x 10^6*	*10*

(Rule 1200-2-4-.05, continued)

Authority: *T.C.A. §68-23-101 et seq.* ***Administrative History:*** *Original rule certified June 7, 1974. Amendment filed August 15, 1978; effective October 2, 1978. Amendment filed April 3, 1986; effective May 31, 1986. Amendment filed March 31, 1992; effective May 15, 1992.*

1200-2-4-.06 UNITS OF RADIOACTIVITY.

Radioactivity is commonly, and for purpose of these regulations shall be expressed in terms of disintegrations per unit time or in curies. One curie (Ci) = 3.7(E+10) [6] disintegrations per second (dps). Commonly used submultiples of the curie are the millicurie (mCi) = 0.001 Ci = 3.7(E+7) dps and microcurie (μCi) = 0.000001 Ci = 3.7(E+4) dps. One disintegration per second is a becquerel (Bq).

Authority: *T.C.A. §§68-28-101 et seq., 68-28-206, and 4-5-201 et seq.* ***Administrative History:*** *Original rule certified June 7, 1974. Amendment filed August 15, 1978; effective October 2, 1978. Amendment filed April 3, 1986; effective May 31, 1986. Amendment filed May 9, 1990; effective August 29, 1990.*

1200-2-4-.07 NOTIFICATIONS, REPORTS AND OTHER COMMUNICATIONS.

(1) Address notifications and reports required by these regulations, communications concerning these regulations and applications filed thereunder as follows:

(a) Telephone notifications and communications, 7:00 a.m. Central Time to 4:30 p.m. Central Time, except weekends and holidays:

Division of Radiological Health.....615–532–0364

(b) Telephone notifications, all other times:

Tennessee Emergency Management Agency (TEMA):.....1–800–262–3300

(c) Applications, written notifications, reports and communications:

Division of Radiological Health
Tennessee Department of Environment and Conservation
L & C Annex, Third Floor
401 Church Street
Nashville, Tennessee 37243–1532

(d) Facsimile communications:

Division of Radiological Health.....615–532–7938

(2) Reserved.

Authority: *T.C.A. §4-5-201 et seq., 68-202-101 et seq., and 68-202-201 et seq.* ***Administrative History:*** *Original rule certified June 7, 1974. Amendment filed August 15, 1978; effective October 2, 1978. Amendment filed April 3, 1986; effective May 31, 1986. Repeal and new rule filed November 17, 2005; effective January 31, 2006.*

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[6] *Example: 3.7 (E+10) is to be read 3.7 times 10 the 10th power.*

(Rule 1200-2-4-.07, continued)

1200-2-4-.08 APPLICATIONS FOR EXEMPTIONS.

The Department may, upon application by any person or upon its own initiative, grant exemptions, variances, or exceptions from the requirements of these regulations which are not prohibited by statute and which will not result in undue hazard to public health and safety or property.

Authority: *T.C.A. §68-28-101 et seq.* ***Administrative History:*** *Original rule certified June 7, 1974. Amendment filed August 15, 1978; effective October 2, 1978. Amendment filed April 3, 1986; effective May 31, 1986.*

1200-2-4-.09 PROHIBITED USES OF SOURCES OF RADIATION.

(1) The use of sources of radiation may be prohibited when it is determined by the Department to be detrimental to public health and safety or property. This action to prohibit will be by issuance of a Commissioner Order or Emergency Order.

(2) No person shall use sources of radiation in a manner to intentionally expose any individual except as specifically allowed by these regulations or by license, registration, or Certified Registration authorization. Use of sources of radiation on humans for research purposes must be specifically approved as provided for by the Department's policy on Experimental Exposure of Humans to Ionizing Radiation or in the case of radiopharmaceuticals by the U.S. Food and Drug Administration.

Authority: *T.C.A. §68-202-101 et seq.* ***Administrative History:*** *Original rule certified June 7, 1974. Amendment filed August 15, 1978; effective October 2, 1978. Amendment filed December 15, 1982; effective January 14, 1983. Amendment filed April 3, 1986; effective May 31, 1986.*

1200-2-4-.10 PROPRIETARY INFORMATION.

Proprietary information is defined as the below listed information supplied to the Division pursuant to the Radiological Health Service Act and is claimed in writing by the person required to supply the information as proprietary as follows:

(1) Blueprints and flow diagrams of the individual's manufacturing processes covered by the registration, license and and/or application;

(2) Detailed narrative of processes including listings of raw materials, composition and manufacturing protocol;

(3) Customer lists; and

(4) Individual medical records and/or radiation exposure records including bioassay results.

Authority: *T.C.A. §68-202-101 et seq.* ***Administrative History:*** *Original rule filed March 22, 1990; effective June 26, 1990.*

1200-2-4-.11 POSTING OF NOTICES TO WORKERS.

(1) Each licensee or registrant shall post current copies of the following documents, as applicable, in a sufficient number of places to permit workers to observe them on the way to or from any particular licensed or registered activity location to which the document applies. Documents shall be placed in a conspicuous position and replaced if removed or altered:

(a) "State Regulations for Protection Against Radiation;"

(b) Radioactive material license, license conditions, documents incorporated into a license by reference and amendments thereto;

(c) Certified registration and amendments thereto;

(d) Registration of x-ray producing equipment;

(e) Operating and emergency procedures applicable to licensed or registered activities;

(f) Any written notice that these regulations have been violated shall be posted within two (2) working days after receipt of the documents from the Division and the licensee's or registrant's response, if any, shall be posted within two (2) working days after dispatch from the licensee or registrant. These documents shall remain posted for a minimum of five (5) working days or until action correcting the violation has been completed, whichever is later.

(g) Form RHS 8-3 (Notice to Employees). Copies of this form may be obtained by writing the Division of Radiological Health at the address given in Rule 1200-2-4-.07.

(2) Instead of posting a document specified in subparagraphs 1200-2-4-.11(1)(a) through (e), the licensee or registrant may post a notice that describes the document and states where it may be examined.

(3) Form RHS 8–3 (Notice to Employees).

(Rule 1240-2-4-.11, continued)

TENNESSEE DEPARTMENT OF ENVIRONMENT AND CONSERVATION

DIVISION OF RADIOLOGICAL HEALTH

NOTICE TO EMPLOYEES

In "STATE REGULATIONS FOR PROTECTION AGAINST RADIATION", The Tennessee Department of Environment and Conservation has established standards for your protection against radiation hazards and certain provisions for the option of workers engaged in work under licenses or registrations issued by the Department.

YOUR EMPLOYER'S RESPONSIBILITY

Your employer is required to–

1. Apply these regulations to work under the license or registration. Licenses and Certified Registrations contain special conditions which shall be considered in addition to these regulations.
2. Post or otherwise make available to you a copy of the regulations, licenses, registrations, and operating procedures which apply to work in which you are engaged, and explain their provisions to you.
3. Post any written notice from the Department that the regulations have been violated and response to such notice.

YOUR RESPONSIBILITY AS A WORKER

You should familiarize yourself with those provisions of the regulations, and the operating procedures which apply to the work in which you are engaged. You should observe their provisions for your own protection and protection of your co–workers.

AREAS COVERED BY THESE REGULATIONS

1. Limits on exposure to radiation and radioactive material in restricted and unrestricted areas;
2. Measures to be taken after accidental exposure;
3. Personnel monitoring, surveys and equipment;
4. Caution signs, labels and safety interlock equipment;
5. Exposure records and reports;
6. Option for workers regarding the Department's inspection; and
7. Related matters.

REPORTS ON YOUR RADIATION EXPOSURE HISTORY

1. The Department's regulations require that your employer give you a written report if you receive an exposure in excess of any applicable limit as set forth in the regulations or in the license. The basic limits for exposure to employees are set forth in Rules 1200–2–5–.50, 1200–2–5–.53 and 1200–2–5–.55 of the regulations. These rules specify limits on exposure to radiation and exposure to concentrations of radioactive material in air and water.
2. If you work where personnel monitoring is required and if you request information on your radiation exposures;

   a. your employer must advise you annually of your exposure to radiation; and

   b. your employer must give you a written report, following termination of your employment, of your radiation exposures.

INSPECTIONS

All licensed or registered activities are subject to inspection by representatives of the Department. In addition, any worker or representative of workers who believes that there is a violation of the regulations or the terms of the employer's license or registration with regard to radiological working conditions in which the worker is engaged, may request an inspection by sending a notice of the alleged violation to the Tennessee Department of Environment and Conservation, Division of Radiological Health, L & C Annex, 3rd Floor, 401 Church Street, Nashville, Tennessee 37243–1532. The request must set forth the specific grounds for the notice, and must be signed by the worker or the representative of the workers. During inspections, Department inspectors may confer privately with workers, and any worker may bring to the attention of the inspectors any past or present condition which he believes contributed to or caused any violation as described above.

POSTING REQUIREMENT

Copies of this notice must be posted in a sufficient number of places in every establishment where employees are employed in activities registered or licensed pursuant to Chapter 1200–2–10 to permit employees working in or frequenting any portion of a restricted area to observe a copy on the way to or from their place of employment.

(Rule 1200-2-4-.11, continued)

Authority: *T.C.A. §§4-5-201 et seq. and 68-202-101 et seq.* ***Administrative History:*** *Original rule filed July 18, 2002; effective October 1, 2002. Amendment filed November 17, 2005; effective January 31, 2006.*

1200-2-4-.12 INSTRUCTIONS TO WORKERS.

(1) Each licensee or registrant is responsible that all individuals who in the course of employment are likely to receive in a year an occupational dose in excess of 100 mrem (1mSv):

(a) 1. Shall be kept informed of the storage, transfer or use of sources of radiation;

2. Shall be instructed:

(i) In the health protection problems associated with exposure to sources of radiation,

(ii) In precautions or procedures to minimize radiation exposure, and

(iii) In the purposes and functions of protective devices employed;

3. Shall be instructed in, and required to observe, to the extent within the worker's control, the applicable Division regulations, registrations and licenses for the protection of individuals from sources of radiation;

4. Shall be instructed in any operating and emergency procedures applicable to the licensed or registered activities in which the individual is involved;

5. Shall be instructed of their responsibility to report promptly to the licensee or registrant any condition that may lead to or cause a violation of Division regulations, registration and licenses or unnecessary exposure to sources of radiation;

6. Instructed in the appropriate response to warnings made in case of any unusual occurrence or malfunction that may involve exposure to sources of radiation;

7. Shall be advised that workers may request radiation exposure reports under Rule 1200-2-5-.142.

(2) In determining individuals subject to paragraph (1), licensees and registrants shall consider assigned activities during normal and abnormal situations involving exposure to sources of radiation that can reasonably occur during the life of a licensed or registered facility. The extent of these instructions shall be commensurate with potential radiological health protection problems in the work place.

Authority: *T.C.A. §§4-5-201 et seq. and 68-202-101 et seq.* ***Administrative History:*** *Original rule filed July 18, 2002; effective October 1, 2002.*

1200-2-4-.13 DELIBERATE MISCONDUCT.

(1) Any licensee, registrant, applicant for a license or registration, employee of a licensee, registrant or applicant; or any contractor (including a supplier or consultant), subcontractor, employee of a contractor or subcontractor of any licensee or registrant or applicant for a license or registration is subject to this rule.

(2) A person who knowingly provides to any licensee, registrant, applicant, contractor or subcontractor, any components, equipment, materials, or other goods or services that relate to a licensee's, registrant's or applicant's activities under these regulations, shall not:

(Rule 1200-2-4-.13, continued)

(a) Engage in deliberate misconduct that causes or would have caused, if not detected, a licensee, registrant or applicant to be in violation of any rule, regulation or order; or any term, condition, or limitation of any license or registration issued by the Division; or

(b) Deliberately submit to the Division, a licensee, a registrant, an applicant, or a licensee's or registrant's contractor or subcontractor, information that the person submitting the information knows to be incomplete or inaccurate in some respect material to the Division.

(3) A person who violates subparagraph 1200-2-4-.13(2)(a) or (b) may be subject to possible civil and criminal penalties.

(4) For the purposes of subparagraph 1200-2-4-.13(2)(a), deliberate misconduct by a person means an intentional act or omission that the person knows:

(a) Would cause a licensee, registrant or applicant to be in violation of any rule, regulation, or order; or any term, condition, or limitation of any license or registration issued by the Division; or

(b) Constitutes a violation of a requirement, procedure, instruction, contract, purchase order or policy of a licensee, registrant, applicant, contractor or subcontractor.

Authority: *T.C.A. §§4-5-201 et seq. and 68-202-203 and 206.* ***Administrative History:*** *Original rule filed July 18, 2002; effective October 1, 2002.*